Re-thinking the current ascochyta blight control strategy in field peas

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Key findings

- The recommended industry practice of P-Pickel T® (PPT) seed treatment and two foliar fungicides of mancozeb failed to significantly reduce disease infection levels or increase grain yield over untreated control treatments under high blackspot disease pressure in 2016.
- Early disease control applications (four weeks after sowing) were important for reducing initial blackspot infection levels at Minnipa, conversely later Spring applications were important at the higher rainfall site of Hart.
- Over two consecutive years, a yield benefit of at least 15% has been obtained from application of new experimental fungicide actives over the current industry practice treatment.
- Further research is required to understand the interaction in efficacy between fungicides and timing of disease infection, together with the drivers of ascochyta blight onset and progression in different field pea growing environments.

Why do the trial?

Ascochyta blight (AB) commonly known as blackspot is an important disease in field peas, and a concern in low rainfall zones where, in high disease forecast situations, the risk is managed by delaying sowing which in turn often leads to yield loss. To enable earlier sowings, foliar fungicides for the control of AB are an important component of disease management which assists in maintaining yield potential.

The current trials are in the second year, as part of ongoing research aimed at developing improved AB disease control management strategies through the use of fungicides. The existing industry practice for AB control in field peas was developed by SARDI (McMurray *et al.*) and includes the use of a fungicide application strategy of P-Pickel T® seed dressing followed by two foliar applications of mancozeb (2 kg/ha at 9 node and early flowering). This strategy developed in 2011 has been shown to suppress AB and is generally a viable economical option for crops yielding 1.5 t/ha or greater. Research conducted in 2015 to test the efficacy of alternative fungicides alongside the current industry practice has indicated improved AB disease control together with a yield benefit of up to 15% over the current industry practice. This research also identified that the severity of disease onset was higher at an earlier growth stage in low rainfall environments such as Minnipa, SA. As such, the timing of the first foliar fungicide, at eight weeks after sowing (WAS) was thought to be too late for effective control of AB in these environments. Further, in medium rainfall environments, more favourable Spring conditions often extend late season disease progression and therefore sprays towards the back-end of the growing season may be required. The aim of the 2016 trials was to further assess these new experimental fungicides alongside the current strategy and also include variations in fungicide application timings to improve disease control efficacy.

How was it done?

Field trials were conducted in two major field pea production areas in South Australia; Hart (medium rainfall zone, Mid-North) and Minnipa (lower rainfall zone, Upper Eyre Peninsula). Trials were designed as randomised complete block design (RCBD), replicated three times with twelve fungicide treatments including an untreated control (nil). Fungicides were applied either as a seed dressing, as fluid injection, or as combinations of seed dressing/fluid injection and foliar fungicide(s) at strategic growth stages as shown in Table 1. Fortnightly applications of chlorothalonil were included as a second control treatment which was aimed at maximum control of AB disease. The dual purpose (grain/forage) field pea type PBA Coogee was sown at 55 plants/m^2 at all sites, selected for its increased biomass production, lodging and AB susceptibility over Kaspa. The plot sizes were 10 m by 2 m with six rows sown on 9 inch (22.5 cm) and 10 inch (26 cm) spacings at Hart and Minnipa respectively. Trial sowing dates were 10 May at Hart and 6 May at Minnipa. The sowing dates at the two sites corresponded to a medium blackspot risk sowing window as forecasted by the Blackspot Manager, DAFWA Crop Disease Forecasts, May 2016.

In order to accelerate AB infection in both trials field pea stubble infested with AB from the previous season was uniformly spread adjacent to seedlings at 1 to 2 nodes growth stage. The disease severity of AB within a plot was assessed as the percentage of plants covered by AB symptoms (purplish-black necrotic lesions on leaves) x frequency of infected plants per plot at vegetative (7 node) and early bud development (13 node) growth stages. Further, a quantitative assessment on the vertical progression of AB on individual plants was conducted at mid to late flowering stage by randomly selecting five plants per plot and assessing the number of girdled nodes as a proportion of total nodes per plant per plot and thereafter using the scores to develop a disease index (DI).

***** Some of the fungicide treatments in this research contain unregistered fungicides, application rates and timings and were undertaken for experimental purposes only. The results within this document do not constitute a recommendation for that particular use by the author or author's organisation.***

Dr Jenny Davidson, SARDI talking to farmers on fungicide management in pulses at the Hart Winter Walk, 2016.

Table 1. Summary of fungicide treatments and application timings as applied to field pea AB management trials at Hart (Mid-North) and Minnipa (Upper Eyre Peninsula), SA 2016.

Treatment*	Seed tmt	Seeding	4 WAS^	6 WAS^	9 WAS^	Early flower	Mid Flower	Late Flower
Nil								
PPT	PPT							
Chloro	PPT		Chloro	10 sprays (applied fortnightly) →				
Sys	PPT							
Flu		Flu						
Av.Xpro	PPT			Av.Xpro		Av.Xpro		
Ami.Xtra	PPT			Ami.Xtra		Ami.Xtra		
Uni+Ami.Xtra		Uni		Ami.Xtra		Ami.Xtra		
Flu+Avi.Xpro		Flu		Av.Xpro		Av.Xpro		
Ami.Xtra	PPT			Ami.Xtra		Ami.Xtra		
Av.Xpro early + Manc	PPT		Av.Xpro		Av.Xpro	Manc.		
Manc. Low	PPT		Manc.		Manc.	Manc.	Manc.	Manc.
Manc Std.	PPT			Manc.		Manc.		

***Fungicide treatment legend and application rates**

1. Nil = no treatment applied
2. PPT = P Pickle T® (PPT) - 200 ml/100 kg seed
3. Chloro = chlorothalonil - 2 L/ha
4. Sys = Systiva – 150 ml/100 kg seed
5. Flu = fluid injection: Flutriafol – 400 ml/ha
6. Uni = fluid injection: Uniform – 400 ml/ha
7. Avi.Xpro = Aviator Xpro® - 600 ml/ha
8. Ami.Xtra = Amistar Xtra® - 600 ml/ha
9. Manc low = mancozeb – 0.5 kg/ha
10. Manc Std. = mancozeb – 2 kg/ha

All treatments were treated with Apron® (350 g/L Matalaxyl-M) seed dressing to control downy mildew.

^WAS = weeks after sowing

Results and discussion

In 2016, the growing season rainfall (GSR) was above long term averages at both sites. A total of 356 and 268 mm was recorded for the months of April to October, at Hart and Minnipa respectively. The two trials were sown in late Autumn in relatively dry seed bed conditions, however, this was followed by wet conditions in Winter and a relatively cool Spring which resulted in prolonged maturation of the crop especially at Hart.

Effect of fungicide treatments on disease severity

The results obtained from the assessment of disease severity at the late vegetative (7 node) and early bud development (13 node) growth stage indicated a site x fungicide treatment interaction. This suggests that fungicide treatment response in controlling AB disease changed significantly with environmental (site) conditions. Assessment of AB disease responses at 7 node only evaluated the effect of fungicides that had been applied at seeding, four and six WAS (weeks after sowing) while that conducted at 13 node evaluated the effect of fungicides that had been applied at seeding, four, six, and nine WAS.

Disease severity at the 7 node assessment period was higher in the nil treatment at Minnipa (42%) than at Hart (13%) (Table 2). This was a similar finding to that found in 2015 highlighting the importance of early season disease control at Minnipa. Aviator Xpro® applied at four WAS and fortnightly chlorothalonil treatments (first treatment commenced at 4 WAS) showed varying but improved disease control over all other treatments at both sites. This indicated that early application timings at between 2 and 4 node improved early season disease control over later application at six WAS (5-6 node). The current industry practice, mancozeb (2 kg/ha) applied at six WAS reduced infection levels compared to nil at Hart but not at Minnipa where disease severity was higher. This finding suggests that there may be differences in efficacy between fungicides depending upon the level of disease pressure.

At the 13 node assessment period, the current industry practice, mancozeb (2 kg/ha) treatment, reduced infection levels similar to the fortnightly chlorothalonil and all the Aviator Xpro® treatments at Hart only (Table 2). This suggested that in some instances where AB infection is relatively low, these three fungicides may offer similar levels of disease control. At Minnipa, however, the fortnightly chlorothalonil had the highest level of disease control over all other treatments. Differences between other foliar fungicides were less obvious and only the Flutriafol + Aviator Xpro® treatment applied at six WAS showed improved disease control over the nil treatment. In most instances, Amistar Xtra® treatments and the lower rate of mancozeb (500 g/ha) treatment did not reduce infection levels over the nil or the current industry standard of mancozeb (2 kg/ha) treatments.

The disease index scores at the mid flowering stage showed that the effect of fungicide treatments in controlling disease was similar across both sites. Notably, disease infection was high among all treatments including the fortnightly chlorothalonil treatment which was shown to have up to 60% infection level across both sites (Figure 1). However this treatment, as expected, still had an improved level of disease control over all other treatments at both sites. This was followed by the flutriafol + Aviator Xpro® treatment which also had lower AB infection levels than the current industry practice of mancozeb (2 kg/ha). Again this observation suggested that Aviator Xpro® as a product had better efficacy in improving disease control (20%) over the industry practice mancozeb (2 kg/ha) treatment especially at this critical period of mid-late flowering and pod-filling.

Table 2. Ascochyta blight disease severity assessed at 7 and 13 node (percentage plot severity) in field pea (PBA Coogee) under different fungicide treatments at Hart (Mid-North) and Minnipa (Upper Eyre Peninsula), SA, 2016.

	Disease severity at 7 node (% plant disease)				Disease severity at 13 node (% plant disease)	
Fungicide Treatment*	**Hart Log (base 10)**	**Hart Raw data**	**Minnipa Log (base 10)**	**Minnipa Raw data**	**Hart**	**Minnipa**
Nil	1.12	13.1	1.62	41.6	32	51
Sys	1.03	10.6	1.58	38.3	35	45
PPT	0.84	6.8	1.62	41.6	36	46
Flu	0.77	5.8	1.6	40	24	51
Manc.Std	0.77	5.8	1.6	40	24	47
Manc. Low	0.82	6.5	1.6	40	32	47
Ami.Xtra	0.84	6.8	1.62	41.6	33	49
Avi.Xpro	0.77	5.8	1.6	40	24	46
Uni+Ami.Xtra	1.05	11.3	1.58	38.3	32	47
Flu + Avi.Xpro	0.5	3.2	1.54	35	19	41
Avi.Xpro early + Manc	0	1	0.9	7.9	17	42
Chloro	0.1	1.3	0.5	3.1	14	25
LSD (P<0.05)	**0.19**		**0.19**		**7.8**	

*Refer to treatment legend in Table 1 for treatment identification

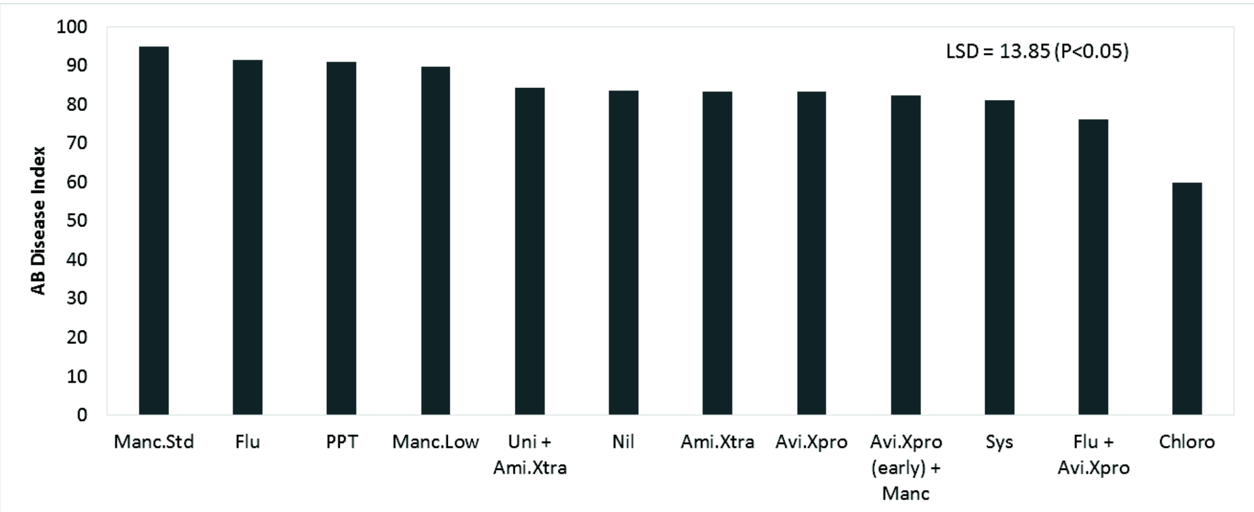

*Figure 1. Ascochyta blight disease index developed from a quantitative assessment of the number of girdled nodes on individual field pea plants at mid-late flowering under different fungicide treatments at Hart (Mid-North) and Minnipa (Upper Eyre Peninsula), SA, 2016. (*Refer to treatment legend in Table 1 for treatment identification.)*

Effect of fungicide treatments on grain yield

There was a site by fungicide interaction for grain yield. Higher yields were recorded at Hart (1.74 t/ha) than at Minnipa (1.30 t/ha) which is likely to be due to higher rainfall and a longer and more favourable season finish (Table 3). The disease index scores showed that disease was strongly correlated (R^2=0.72, P≤ 0.05, data not presented) with grain yields across the two sites hence disease was a major driver in yield loss in 2016. At Hart, the highest grain yields were recorded from the fortnightly chlorothalonil (2.67 t/ha) treatment over all other treatments. This treatment received its last fungicide spray in early Spring, 8 November, which was almost three and half months after the early flowering stage compared when most other treatments had ceased having foliar sprays (15 August). Comparatively at Minnipa the last chlorothalonil spray was applied on the 19 October, two months after the early flowering stage sprays (17 August) highlighting the longer and more favourable finishing conditions experienced at Hart. Yields at Hart were improved by 20% from the use of Aviator Xpro® and Amistar Xtra® treatment over the current industry practice, mancozeb (2 kg/ha) and the nil treatment which both yielded similarly.

At Minnipa, the fortnightly chlorothalonil treatment yielded similar to a number of treatments including all Aviator Xpro® treatments, one of the Amistar Xtra® and the lower rate of mancozeb (500 g/ha) which was applied at five separate occasions. The performance of these fungicides in grain yield response was quite remarkable given that the fortnightly chlorothalonil treatment had received up to 10 sprays whereas the other treatments had only received sprays ranging from two to five in number. Notably, there was no yield improvement from the application of the current industry practice, mancozeb (2 kg/ha) over the nil treatment. These results suggested that both application timing and type of product were important for disease control under high disease pressure conditions at both sites in 2016.

Table 3. Average yield (t/ha) of field pea (PBA Coogee) under different fungicide treatments at Hart (Mid-North) and Minnipa (Upper Eyre Peninsula) SA, 2016.

	Grain yield (t/ha)	
Fungicide treatment*	**Hart**	**Minnipa**
Nil	1.49	0.95
Sys	1.55	1.19
PPT	1.33	1.05
Flu	1.49	1.1
Manc. Std	1.54	1.19
Manc. Low	1.6	1.37
Ami.Xtra	1.84	1.32
Avi.Xpro	1.93	1.4
Uni. + Ami.Xtra	1.91	1.21
Flu. + Avi.Xpro	1.89	1.57
Avi.Xpro (early) + Manc.	1.65	1.58
Chloro	2.67	1.67
LSD (P<0.05)	**0.336**	

*Refer to treatment legend in Table 1 for treatment identification.

Summary / implications

Above average rainfall together with effective inoculation of AB favoured early and high disease development and progression at Minnipa. In contrast cooler Spring conditions and higher rainfall amounts led to a longer maturation period and prolonged exposure of unprotected new plant growth to late AB disease infection at Hart. These differences in environmental conditions are likely to have accounted for site by fungicide treatment interaction for disease severity and grain yield response between the two sites.

The current industry practice of two strategic foliar sprays of mancozeb (2 kg/ha) at vegetative and early flowering growth stages did not effectively control disease or result in a yield improvement over the unsprayed nil treatment in a susceptible field pea variety under high disease pressure in 2016. In comparison, Aviator Xpro® and Amistar Xtra® in various combinations, showed improved levels of disease control over the current industry practice of mancozeb (2 kg/ha) and the nil treatment. At Minnipa the early application of Aviator Xpro® showed improved control and reduced early infection levels over later application timings of similar treatments. Reducing the rate of application of mancozeb from 2 kg/ha to 500 g/ha and splitting applications over five timings, showed improved disease control at Hart but not at Minnipa. While the fortnightly chlorothalonil treatment reduced disease pressure considerably over other treatments it only achieved a disease index rating of 60% across both sites at the early flowering stage indicating a large amount of disease infection still occurred. Higher relative yields at Hart from the prolonged application of the fortnightly chlorothalonil treatment demonstrate the importance of late disease control especially in longer more favourable seasons and environments.

In comparison to the current industry practice, of mancozeb (2 kg/ha), the two experimental fungicide products, Aviator Xpro® and Amistar Xtra® showed yield benefits of at least 19% across the two sites under high disease severity. A similar trial conducted in 2015 also showed a yield benefit of approximately 15% from the application of these new fungicide products. Further testing will be carried out in the 2017 season to confirm these findings across seasons and environments. It is also worth noting that the levels of AB inoculation from infested pea stubble may be higher than those commonly encountered in the paddocks, therefore our results should be interpreted with caution.

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